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.003Hz to 30MHz

LIN/LOG SWEEP GENERATOR

Model 2200

PRELIMINARY MANUAL

Serial No 165A

OPERATING AND MAINTENANCE MANUAL

KROHN-HITE CORPORATION

Avon Industrial Park/Bodwell St., Avon Massachusetts 02322 U.S.A.

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ween the START and STOP frequency settings, at a rate controlled
the SWEEP DURATION controls.

.19 START PHASE control

the MODE switch to PULSE and the WAVEFORM switch to ∿. Adjust
SWEEP DURATION control to obtain one or two single cycles on
oscilloscope. Vary the START PHASE control from max CCW to
CW; the start of the sinewave should vary from approximately
° to approximately +90°.

.20 FREQUENCY PAUSE-MARKER and MARK GATE OUT

FREQUENCY PAUSE-MARKER feature is functional only during an up-
quency sweep. To check the PAUSE feature, set the MODE switch
CONT SWP and set the START and STOP frequency controls to 0.3
30 respectively, on the linear scale. Set the FREQUENCY Hz-
KER dial and MULTIPLIER to 10 x 1k.

nect the RAMP OUT to the oscilloscope. Set the SWEEP RANGE
trol to 1s-10ms SWEEP DURATION to max CW. Set the MARK RANGE
trol to the 10ms-0.1ms position and switch the PAUSE switch to

erve the ramp voltage on the oscilloscope. Check that the
ation of the ramp pause can be varied by the MARK DURATION
trol. Rotate the MARK DURATION control to its CCW position.
ate the FREQUENCY Hz/MARKER dial; you should be able to vary
level of the pause over the Ramp duration.

nect the MARK GATE OUT to the alternate input channel of the
illoscope. The MARK GATE OUT should produce a TTL pulse whose
th is coincident with the MARK DURATION setting.

.21 MARK TRIG input

MARK TRIG input provides an external control of the start of
pause-marker. Any connection made to this input disables the
QUENCY Hz/MARKER dial control. The start of the pause will
triggered by the falling edge of a TTL pulse.

.22 PEN LIFT OUTPUT

PEN LIFT output is a TTL pulse that goes "high" (approximately
V) during a frequency sweep or pause. The output may be checked with
oscilloscope or a DC voltmeter. Set the MODE switch to TRIG
; the PEN LIFT output should be "low" (approximately 0.4V).
ress the MANUAL TRIG/GATE button; the PEN LIFT output should go
gh" during the duration of the sweep.

3.3.13 TRIG mode

Set the MODE switch to TRIG, and the FREQUENCY Hz/MARKER dial MULTIPLIER to 10 x 1k. The generator should produce one cycle of dial frequency or one pulse of one-half the dial period each time the MANUAL TRIG/GATE button is depressed.

3.3.14 BURST mode

Set the MODE switch to BURST. The burst frequency is controll by the FREQUENCY Hz/MARKER dial and MULTIPLIER. The burst duration and rep-rate are controlled by the TRIG/GATE LEVEL an SWEEP DURATION controls, respectively.

3.3.15 PULSE mode

Set the MODE switch to PULSE. You should be able to vary the pulse width and rep-rate by the FREQUENCY dial and SWEEP DURAT controls, respectively.

3.3.16 CONT SWP mode

Set the mode switch to CONT SWP. The output frequency should sweep between the limits set by the sweep START and STOP contr at a rate set by SWEEP DURATION controls.

3.3.17 TRIG SWP mode

Set the MODE switch to TRIG SWP. The generator should be hold at the START frequency setting. Depress the MANUAL TRIG/GATE button; the generator should produce a single sweep to the STO frequency setting, at a rate controlled by the SWEEP DURATION control, then should reset to the START frequency setting.

3.3.18 TRIG SWP BURST mode

Set the MODE switch to TRIG SWP BURST. Depress the MANUAL TRI GATE button; the generator should produce a single swept burst

onnect the ACVM to the generator's main output. Set the WAVEFORM witch ∿. Vary the generator frequency up to 300 kHz; the ariations in output amplitude should be less than 0.1 db (approx- nately 1%). Increase the generator to 3 MHz; variations in mplitude should be less than 0.2 db. Repeat this with the WAVE- ORM switch in the ∿ mode; variations in the triangle amplitude hould be less than 0.1 db to 300 kHz, and less than 1 db to 3 MHz.

or frequencies between 3-30 MHz, the response of the generator may e checked with the oscilloscope. Set the generator initially to 00 kHz (30 x 10k) and adjust the scope vertical gain for a reference isplay. Switch to the x1M multiplier position; and tune the enerator frequency from 3 MHz-30 MHz; peak to peak variations hould be less than 1 db for the sinewave, and less than 4 db for the riangle wave.

.3.9 Sinewave Distortion

onnect the distortion analyzer to the generator's MAIN OUT. Set he WAVEFORM switch to ∿. Check the distortion of the output inewave at various frequencies. Distortion should be less than 0.5%, rom 0.1 Hz to 300 kHz.

he use of a wave or spectrum analyzer may prove more feasible for igher frequency distortion measurements. Total harmonic distortion etween 300 kHz-3 MHz should be less than 2% of the fundamental. generator frequencies above 3 MHz, all harmonics should be down at least -22 db. Disconnect the analyzer from the main output.

.3.10 TTL Output

onnect the oscilloscope to the TTL output, and set the generator requency to between 1-10 kHz. Check to see that the waveform mplitude is between approximately +.3V to +3.0V.

.3.11 SWEEP (Ramp) DURATION and Manual HOLD

onnect the oscilloscope to the RAMP OUT connector and check for a volt peak, linear ramp.

he Ramp duration may be measured by using either the oscilloscope, a frequency counter set for period operation. Vary the SWEEP URATION control in each position of the SWEEP RANGE switch; the amp duration should cover the ranges indicated.

et the SWEEP DURATION to a slow period (approximately 10s) and bserve the RAMP OUT on the oscilloscope. Switch the manual HOLD witch to the HOLD mode; the ramp voltage should hold at a DC level. eturn the HOLD switch to the RUN mode; the ramp will resume its ositive excursion.

.3.12 GATE mode

et the mode switch to GATE; the generator should produce a cont- nuous output as long as the MANUAL TRIG/GATE button is depressed.

position of the FIXED OFFSET control; the waveform amplitude should be reduced to one-half, while its positive peak should be set for zero volts. Return the FIXED OFFSET control to the (off) position.

3.3.4 Symmetry Control

Set the WAVEFORM switch to ⎍; pull the SYMMETRY control ON; you should be able to adjust the output squarewave negative duration with respect to the positive duration by a ratio of 100:1. Return the SYMMETRY control to the "OFF" position.

3.3.5 Frequency Controls and Accuracy

Connect the frequency counter to the MAIN OUT (WAVEFORM switch on ⎍) and check the accuracy of the frequency dial in each position of the MULTIPLIER. Frequency accuracy is specified as 2% of full scale on bands 1-7 (X.1-X100K) and 3.5% on band 8 (X1M).

3.3.6 External Voltage Control (VC)

Connect a zero to ±3 volt DC source to the VC input. Vary the DC source and observe the change in the generator's frequency.

Disconnect the DC voltage source from the VC input.

3.3.7 CV(Control Voltage) Output

The CV output is a DC voltage proportional to the generator frequency. Connect the DCVM to the CV output and check to see that its value is within 1% of the frequency rading observed on the frequency counter (1 to 30 on the dial, bands 1-7 only). Disconnect the frequency counter and DCVM.

3.3.8 Frequency Response

The frequency response specifications apply to sinewave and triangle output only.

XED DC OFFSET	⌐└(Off)
RIABLE DC OFFSET	Off
MMETRY	Off
ASSIS/FLOATING	Chassis

CAUTION!

The covers of this instrument should not be removed when the instrument is connected to an AC power source, because of the potentially dangerous voltages that exist within the unit.

3.1 Waveforms

nnect the oscilloscope to the generator's MAIN OUT. Operate e WAVEFORM switch in each of its positions; the waveforms should undistorted and at least 30 volts peak to peak.

3.2 Amplitude Controls

ry the PEAK VOLTS control from amximum to minimum; the waveform plitude should diminish by more than 40dB. Return the PEAK LTS control to its Maximum CW position. Check the operation of e attenuator in each of its positions; the waveform amplitude ould diminish in 20dB steps. The ACVM may be used to further rify the accuracy of the attenuator (±0.1dB). Return the tenuator to the 0dB position.

3.3 DC Offsets

rn the PEAK VOLTS control to its maximum CCW position. Pull e VARIABLE OFFSET control "ON"; you should be able to vary e main output DC level by ±15 volts. Return the VARIABLE OFF- T control to "OFF".

rn the PEAK VOLTS control up to maximum and set the FIXED OFF- T control to the ⌐└(+) position; the output waveform;s amplitude ould be reduced to one-half its p-p value, and its negative ak should start at zero volts. Repeat this for the ⌐┘(-)

SECTION 3

INCOMING INSPECTION AND CHECKOUT

3.1 INTRODUCTION

The following procedure should be used to verify that the gener is operating within specifications, both for incoming inspectio and for routine servicing. Tests should be made with all cover in place, and the procedure given below should be followed in sequence. Familiarize yourself with the initial set-up and oper ating procedures outlined in Section 2, Operation.

3.2 EQUIPMENT REQUIRED

(a) Oscilloscope, bandwidth from DC to 100-150 MHz, verti sensitivity 5 mV/cm, AC/DC coupled, plus vertical amplifier plu in (Tektronix type 7704A Mainframe with 7A13 Differential Compa ator Amplifier and 7B50A Time Base, or equivalents).

(b) Frequency Counter, capable of frequency measurements between .003 Hz and 30 MHz, 0.1% accuracy (General Radio 1192-B of equivalent).

(c) AC Differential Voltmeter (ACVM), 3 MHz bandwidth or greater, for voltage measurements up to 20 volts, and voltage variations less than 0.1 db (1%). (Fluke Model 931A or equival

(d) DC Voltmeter (DCVM), for DC voltage measurements betw zero and ±50 volts (Fluke Model 8000A or equivalent).

(e) Distortion Analyzer, bandwidth at least 300kHz, to measure distortion down to 0.1% (Hewlett Packard Model 333A or equivalent).

(f) Spectrum Analyzer, bandwidth at least 100 MHz, to mea harmonic distortion of frequencies between 300 kHz and 30 MHz. (Hewlett Packard Model 141T Display CRT, with Model 8553B Spect Analyzer, or equivalent).

3.3 PROCEDURE

After allowing the instrument to warm up for at least 30 minute set the controls initially to the following positions:

FREQUENCY Hz/MARKER	30
MULTIPLIER	x100
WAVEFORM	∿
AMPLITUDE	Attenuator set for 0 db, PEAK VOLTS control Max CW.
MODE	CONT

pause period determined by the MARK DURATION and MARK RANGE
ontrols. The RAMP OUT is normally used to drive the scope
orizontal axis when the PAUSE-MARKER feature is used with the
ONT SWP, TRIG SWP or TRIG SWP BURST modes. (Applies to up-
weeping ramps, only).

he Ramp Generator will also produce multiple pauses or a
aircase ramp by applying a series of TTL pulses to the MARK
RIG input. The number of pulses occuring during each Ramp
ıration will determine the number of steps to the staircase,
rovided the pause duration is shorter than the pulse rep-
ıte. The MARK DURATION and MARK RANGE will determine the length
f the pause (tread).

ıch pause of the ramp will be initiated on the falling edge of
ıch TTL pulse applied to the MARK TRIG input. If the generator
s operated in the TRIG SWP or TRIG SWP BURST modes, and the
ılses applied to the MARK TRIG input are also applied to the
RIG/GATE IN, the staircase ramp will then synchronize to the
'L pulses at the MARK/TRIG IN. The rising edge of the first
ılse into the TRIG/GATE IN will trigger the Ramp; the first
ıuse will then always occur one TTL pulse period later.

gure 7 is an oscilloscope trace showing how the staircase may
e generated.

amplitude of the waveform is halved and the negative peak of the waveform is set at zero for positive offset; the positive peak is set for zero with negative offset.

The VARIABLE offset control is a pull-on potentiometer that var the output DC level ±15V. The maximum combined AC plus DC shou not exceed ±15V peak, otherwise clipping of the waveform will occur. When both the FIXED and VARIABLE offset controls are used the waveform amplitude will be halved, and its positive or negative peak may be set between zero and ±15 volts with the VARIABLE offset control. A particular application for this would be to create variuos Hi-Lo logic levels, such as TTL or ECL. Figure 5 illustrates the use of the FIXED and VARIABLE of sets; Figure 6 shows how a logic pulse can be produced by adjus ment of the FREQUENCY dial (positive duration), SYMMETRY contro (negative duration) or SWEEP DURATION in PULSE mode, and FIXED and VARIABLE DC offsets (Hi-Lo levels).

2.3.6 RAMP GENERATOR OUTPUT

The internal Ramp Generator may be used independent of the Main Generator in the CONT, TRIG or GATE modes of operation. Both t linear and log ramps are made available. The linear ramp is a fixed, 3 volt ramp available at the front panel RAMP OUT con- nector. The log ramp is available at the rear panel LOG OUTPUT connector. The beginning and ending voltages of the log ramp a controlled by the sweep START and STOP controls. For a positiv going log ramp (0V to +3V) the sweep START control is set to it high frequency end. For a negative-going ramp (+3V to 0V) the STOP control is set to its low end while the START control is set to its high end.

Both the linear and log ramps are coincident in frequency, thei duration is controlled by the SWEEP DURATION and SWEEP RANGE controls.

If the PAUSE-MARKER feature is used, both the linear and log ra will pause at the frequency of the FREQUENCY Hz/MARKER dial, fo

mp) pauses, and remains high for the duration of the pause, as
by the MARK DURATION control.

pause-marker may also be initiated by a TTL pulse applied
the rear panel MARKER TRIG INPUT. When a connection is made
this input it automatically disengages the FREQUENCY Hz/ MARKER
l. The start of the pause-marker is triggered by the falling
e of the external pulse.

ure 3 shows a typical set-up using the PAUSE-MARKER.

.4 SYMMETRY (neg duration) control

SYMMETRY control on the Model 2200 is unlike conventional
trols found on other generators. The conventional control
y varies the symmetry ratio, that is, as the positive duration
increased, the negative duration will decrease, or vice-versa.
SYMMETRY control of the 2200 controls the negative square-
e duration (rep-rate) and positive sinewave or triangle slope,
ependent of the positive duration (width) and negative slope,
pectively, which are controlled by the FREQUENCY Hz/MARKER dial
MULTIPLIER. The symmetry ratio is adjustable to 100:1 on
n MULTIPLIER range.

SYMMETRY control is functional in all modes. Note: In the
SE mode of operation, the negative duration of the squarewave
controlled by the SWEEP DURATION. The SYMMETRY control will set
inimum negative duration; the SWEEP DURATION control will have
effect below this minimum setting.

ure 4 shows the relationship between positive and negative
ations.

.5 DC Offsets

Model 2200 provides a selection of fixed offset, variable off-
or both. A 3-position slide switch selects fixed positive,
o. or fixed negative offset. In the FIXED OFFSET mode, the

2.3.3 FREQUENCY PAUSE-MARKER

An exclusive feature of the Model 2200 is the Frequency Pause-Marker. This feature allows the user to selectively pause duri each up-frequency sweep, in the CONT SWP, TRIG SWP or TRIG SWP BURST mode, for any period from 0.1ms to infinity. The PAUSE-MARKER also produces a visible marker or intensification at the pause if the swept output is viewed on an oscilloscope and the RAMP OUT used to drive the scope horizontal axis.

To use the PAUSE-MARKER, first select the frequency sweep START and STOP points, and adjust the SWEEP DURATION to the desired rate. Switch the PAUSE to ON; connect the swept output of the circuit being tested to the scope vertical input. Connect the RAMP OUTPUT to the scope horizontal input. The RAMP is used to control the horizontal sweep.

The marker is produced in the following manner:

Since the RAMP OUTPUT is being used to control the horizontal deflection of the scope trace, the CRT beam will sweep from lef to right as long as the RAMP OUTPUT voltage is changing. When pause occurs, the RAMP holds its level for the duration of the pause. This will cause the CRT beam to stop its horizontal deflection until the sweep resumes. What results is an intensifi of the scope trace during the pause period. This intensificati appears as a very narrow pulse that occurs at the frequency of the pause.

The frequency of the pause is controlled by the FREQUENCY Hz/ MARKER dial. The duration of the pause is controlled by a 3-position MARK RANGE selector, that provides pause ranges of 100 1s, 1s-10ms, and 10ms-0.1ms. The MARK DURATION control provide a variable adjustment of each MARK RANGE position. When the MA DURATION is set to its maximum CCW position, the pause period will be infinite, for any of the MARK RANGE positions.

The MARK GATE OUT is a TTL pulse that goes "high" when the swee

E: TRIGGERED SWEEP

put holds at START frequency, single sweeps
n externally or manually triggered, then
ets to start frequency.

Depress TRIG SWP.
Select LIN or LOG.
Set sweep frequency limits with sweep
RT and STOP controls, and frequency MULT-
IER.
Set sweep time with sweep RANGE and DUR-
ON controls.
Adjust TRIG/GATE LEVEL.
Initiate with external or manual trigger.

E: TRIGGERED SWEEP BURST

gle swept burst when externally or man-
ly triggered.

Depress TRIG SWP BURST.
Select LIN or LOG.
Set sweep frequency limits with sweep
RT and STOP controls and frequency MULT-
IER.
Set sweep time with sweep DURATION control.
Adjust TRIG/GATE LEVEL.
Set baseline with START PHASE control.
Initiate with external or manual trig-
.

MODE: TONE BURST

Repetitive tone-burst with variable rep-rate.

a) Depress BURST.
b) Set burst frequency with DIAL and MULT-IPLIER.
c) Set burst rate with sweep DURATION control (100s-0.1ms).
d) Set on/off ratio of burst with TRIG/GATE LEVEL control (5% - 80% of burst rate).
e) Set base line with START-PHASE control.

MODE: PULSE

Repetitive pulse or single-cycle output, with variable rep-rate and width.

a) Depress PULSE.
b) Adjust rep-rate with sweep DURATION control (.01Hz-10kHz).
c) Adjust pulse width with DIAL and MULT-IPLIER (100s-16ns).
d) Set base line with START PHASE control.

MODE: CONTINUOUS SWEEP

Continuous frequency sweep, up or down, linear or log.

a) Depress CONT SWP.
b) Select LIN or LOG.
c) Set sweep frequency limits with sweep START and STOP controls and frequency MULT-IPLIER.
d) Set sweep time with sweep RANGE and DUR-ATION controls.

DE: Continuous and/or External VC.

erates as conventional generator. Ramp
nerator is entirely independent and may be
ed simultaneously.

Depress CONT.
Select frequency with DIAL and MULTIPLIER.
Frequency may also be controlled within
e DIAL range, by an external voltage of zero
±3 volts.

DE: GATE

ntinuous output for duration of external or
nual gate.

Depress GATE.
Select frequency with DIAL and MULTIPLIER.
Adjust TRIG/GATE LEVEL, if required.
Adjust START PHASE for desired setting.
Apply external gate or depress manual
G/GATE.

DE: TRIGGERED

ngle cycle output when externally or manual-
triggered.

Depress TRIG.
Select single cycle period with DIAL
d MULTIPLIER.
Adjust TRIG/GATE LEVEL.
Adjust START PHASE for desired set-
ng.
Initiate with external or manual trigger.

The frequency or period of the output waveform is controlled by the FREQUENCY Hz/MARKER dial and MULTIPLIER in the CONT, GATE, TRIG, BURST and PULSE modes. In the CONT SWP, TRIG SWP and TRIG SWP BURST modes, the frequency sweep range is controlled by the sweep START and STOP controls.

The waveform rep-rate or frequency duration is controlled by an external signal at the TRIG/GATE IN connector, in the TRIG and GATE modes, respectively. In the BURST, PULSE, CONT SPW, TRIG SWP and TRIG SWP BURST modes, the internal Ramp Generator contro the MODE rep-rate and/or duration.

The SYMMETRY control may be used in all modes. When a squarewav output is selected in the PULSE mode of operation, the SYMMETRY control sets a minimum negative duration. The pulse negative duration is then controlled by the internal SWEEP DURATION, down to the minimum duration set by the SYMMETRY control. The SYMMET control will, however, control the sinewave and triangle positiv slope in the PULSE mode.

In the CONT SWP, TRIG SWP and TRIG SWP BURST modes, the SYMMETRY control provides a fixed negative squarewave duration, while the START and STOP controls and the RAMP DURATION determine the limits of the modulated pulse width and pulse-width modulation rate, respectively, of the squarewave positive duration. Conversely, the Main Output sinewave and triangle negative slopes w be modulated.

All parameters of the main generator (AMPLITUDE, WAVEFORM and DC OFFSETS) are adjustable in all modes of operation.

The following is a detailed explanation of the various modes.

e dial determines the frequency or period of the Main Output in
e CONT, TRIG, GATE, PULSE and BURST modes. In the CONT SWP,
IG SWP and TRIG SWP BURST modes, the dial determines the fre-
ency of the pause-marker.

e dial also controls the positive duration (width) of the square-
ve and the negative slope of the sinewave and triangle, when the
MMETRY control is on, in all modes except CONT SWP, TRIG SWP,
TRIG SWP BURST. The SYMMETRY control (Section 2.3.5),
dependently controls the squarewave negative duration (rep-
te) and sinewave and triangle positive slopes.

en the FREQUENCY dial and SYMMETRY control are used together,
ey provide additional sawtooth and pulse waveforms at the MAIN
TPUT.

e positive duration can be calculated as follows:

$$\text{s duration (sec)} = \frac{1}{2\text{x dial (Hz) x MULTIPLIER}}$$

an external voltage is applied to the VC IN connector it will
ry the frequency of the generator about the dial setting and
thin the dial range. If the SYMMETRY control is on, the external
ltage will vary the squarewave positive duration or the sinewave
d triangle negative slope about the dial setting.

3.2 Modes of Operation

e Model 2200 provides a selection of 9 different modes of oper-
ion. Eight of these modes are selected by the pushbutton MODE
itch; the ninth mode of operation is the External Frequency con-
ol. (VC IN) which is functional in all positions of the MODE
itch.

ch position of the MODE switch corresponds to a specific inter-
nnection between the 2200's main generator circuit and its internal
mp generator and gate-trigger circuit to produce the desired
nction.

slow blow fuse for 240V operation.

34 CHASSIS/FLOATING: 2 postion slide switch that disconnects signal ground (⏚) from chassis ground (⏚) when in the FLOATIN position.

35 LINE: Complimentary slide switches for selecting 120 or 24 volt operation, and NORMal or LOW line conditions. the 120/240V LINE switch determines the proper voltage range (90-132V or 180-264V), while the NORM/LO LINE switch selects normal (108-132V, 216-264V) or low (90-110V, 180-220V) line voltage.

36 AC POWER RECEPTACLE: Standard 3-prong connector. A detach able 3-wire line cord is included.

37 LOG OUTPUT: Exponential ramp, frequency coincident with SWEEP DURATION, start and stop voltage levels controlled by swee START and STOP controls, respectively.

38 PEN LIFT: TTL pulse, "high" during sweep and marking.

39 MARKER TRIG INPUT: The start of the pause-marker will be initiated by the trailing edge of a TTL pulse applied to the MAR TRIG input. Multiple pulses applied to this input during each ramp duration will provide a staircase ramp at the RAMP OUTPUT (See Section 2.3.7.) Any connection made to this input will de-activate the front panel MARKER dial control.

2.3 OPERATION

2.3.1 FREQUENCY Hz/MARKER (pos duration) and MULTIPLIER

The FREQUENCY dial is a single turn dial, with a concentric 5:1 vernier drive, and is calibrated in Hertz with a linear scale fr 1 to 30 (.03 to 1 uncalibrated). The effective dial range is 1000:1. The MULTIPLIER is an 8-position, pushbutton control calibrated in decade steps from 0.1 to 1M (10^{6}).

FREQUENCY Hz/MARKER (pos duration): See Section 2.3.1.

VC IN: Input for external voltage control of frequency.
ro to ±3 volts gives 1000:1 frequency control, within dial range.
put impedance, 6k ohms.

CV OUT: DC voltage, proportional to main generator frequency,
V to 3 volts, 1% accuracy over calibrated portion of FREQUENCY
/MARKER dial. Output impedance, 2.4k ohms.

FIXED DC OFFSET: 3 postion slide switch selects zero, or
xed positive or negative offset. See Section 2.3.6.

VARIABLE DC OFFSET: Single turn, pull-on control provides
riable adjustment of Main Output offset. See Section 2.3.6.

PEAK VOLTS: Single turn potentiometer for controlling the
in Output voltage in each position of the AMPLITUDE ATTENUATOR.

MAIN OUT: The selected waveforms appear at this output;
pedance 50 ohms.

WAVEFORM: 3 station pushbutton control selects sine, triangle,
square waveforms. The selected waveform appears at the MAIN
TPUT.

ATTENUATOR (dB): 4 position pushbutton attenuator, calibrated
dB steps from 0dB to -60dB. Attenuator accuracy, ±0.2dB.
nimum output, less than 2 millivolts.

DC LEVEL ADJ: Single turn screwdriver adjust for adjusting
IN OUT DC level.

SYNC INPUT: A 2 volts p-p signal applied to this input will
ck the generator frequency to the SYNC frequency within a 3%
cking range.

FUSE RECEPTACLE: 3/4A slow blow fuse for 120V operation, 3/8A

Also sets start voltage of LOG OUTPUT ramp in non-sweep modes. See Section 2.3.7.

12 SWEEP SELECT: Slide switch to select linear (Lin) or logarithmic (Log) sweep.

13 STOP: Slide control calibrated with same scales as START control, adjusts stop of frequency sweep. Also sets stop voltage of LOG OUTPUT ramp in non-sweep modes. See Section 2.3.7.

14 (SWEEP) DURATION: Single turn control adjust sweep duration in CONT SWP, TRIG SWP, and TRIG SWP modes; adjusts burst and puls rate in BURST and PULSE modes; adjusts RAMP OUT duration in non-sweep modes.

15 HOLD: Toggle switch to manually stop the frequency sweep. Sweep resumes when HOLD switch is returned to RUN mode.

16 (SWEEP) RANGE: 3-position control selects range of ramp or sweep duration: 100s-10s, 1s-10ms and 10ms-0.1ms.

17 RAMP OUT: Linear, 0 to 3 volt ramp, duration adjusted with SWEEP DURATION control. Provides auxiliary output independent of main generator frequency in CONT, TRIG or GATE modes. See Sectio 2.3.7. Used to drive scope horizontal axis to observe FREQUENCY MARKER. See Section 2.3.3.

18 MULTIPLIER: 8-station control, calibrated in decade steps from x.1 to x1M, multiplies FREQUENCY Hz/MARKER dial setting and START and STOP scales.

19 POWER: On-off toggle switch with power-on indicator.

20 SYMMETRY: Pull-on variable control. See Section 2.3.5.

21 TTL OUT: TTL pulse coincident with main generator frequency inverted with respect to MAIN OUTPUT squarewave. Rise and fall less than 6ns. Output impedance, 50 ohms.

RST and TRIG SWP BURST modes. Start-stop points adjustable ±90°
300kHz, ±70° to 3MHz. Produces haversine or havertriangle wave-
rms in TRIG and PULSE modes.

TRIG/GATE LEVEL: Single turn control, varies the threshold
evel of the TRIG/GATE input, for a positive slope between -5V
nd +5V. Hysteresis, 0.5V. In BURST mode, adjusts burst duration
etween 5%-80% of burst period, as determined by SWEEP DURATION
ontrol.

TRIG/GATE IN: Input for external trigger or gate signal.
nput impedance, 10K ohms. Maximum trigger frequency, 10MHz.
ill withstand ±50 volts peak without damage.

PAUSE: Slide switch that activates FREQUENCY PAUSE-MARKER.
ee Section 2.3.3.

MARK DURATION: Single turn control adjusts duration of RAMP
ause and MARK GATE OUTPUT within range determined by MARK RANGE
elector. Rotating MARK DURATION to maximum CCW position provides
nfinite pause in any position of MARK RANGE selector. See
ection 2.3.3.

MARK RANGE: 3 position switch selects range of MARK DURATION:
00s-10s, 1s-10ms, and 10ms-0.1ms. See Section 2.3.3.

MARK/GATE OUT: TTL pulse occurs at pause/marker frequency,
idth coincident with MARK DURATION setting. See Section 2.3.3.

LIMITS Hz: Complimentary LEDs that indicate RAMP (sweep)
atus in CONT SWP, TRIG SWP or TRIG SWP BURST modes. If the RAMP
sweep) is holding at its START or STOP point, the corresponding
ED will be lit. If the RAMP is holding (sweep pause) both LEDs
ill be off. If the generator is sweeping, both LEDs will be on.

START: Slide control calibrated in Hertz with linear scale
rom 0.3 to 30 and log scale from 0.03 to 30, adjusts start of
requency sweep in CONT SWP, TRIG SWP and TRIG SWP BURST modes.

SECTION 2

OPERATION

2.1 POWER REQUIREMENTS

The Model 2200 Lin/Log Sweep Generator may be powered from a sing phase, 50-400Hz AC line voltage of either 90-110/108-132 volts, c 180-220/216-264 volts. The LINE selector switches on the rear panel select the proper mode of operation. All units are shipped with the LINE switches set to 120V and NORM, respectively, and a fuse bag attached to the line cord. The fuse bag contains a 3/8 ampere fuse. For 180V-264V operation, remove the 3/4 ampere fuse located in the fuse receptacle, replace it with the 3/8 ampere fuse from the fuse bag and switch the 120V/240V LINE switc to the 240V position. The NORM (normal)/LO (low) LINE switch is provided for operating with low AC line voltages (90-110 volts or 180-220 volts). A chart is provided on the rear panel showing the correct switch positions required for each line voltage.

CAUTION!

The covers of this instrument should not be removed when the instrument is connected to an AC power source, because of the potentially dangerous voltages that exist within the unit.

2.2 OPERATING CONTROLS, CONNECTORS AND DISPLAYS (See Figure 2)

2.2.1 Front Panel

1 MODE: 8-station pushbutton control for selecting the generat mode of operation. The ninth mode of operation is the External VC control. See Section 2.3.2.

2 MANUAL TRIG/GATE: Pushbutton control to manually trigger or gate the generator frequency in TRIG, GATE, TRIG SWP and TRIG SWE BURST modes.

3 START PHASE: Single turn control adjusts the phase angle at which the sine or triangle waveform start in the TRIG, GATE, PULSE,

SPECIFICATIONS

UTPUT

ms: Sine, square, triangle, pos. and neg. pulses and ramps.

cy Range: 0.003Hz to 30MHz in 8 ranges.

cy Control: Dial calibrated linearly from 1 to 30, and an n pushbutton multiplier switch.

MULTIPLIER	FREQUENCY RANGE
.1	0.003Hz-3Hz
1	0.03Hz-30Hz
10	0.3Hz-300Hz
100	3Hz-3kHz
1K	30Hz-30kHz
10K	300Hz-300kHz
100K	3kHz-3MHz
1M	30kHz-30MHz

cy Accuracy: 2% of full scale on bands 1-7, 3.5% of full band 8.

cy Stability:

tes	0.05% bands 1-7
	0.25% bands 1-6, 1% bands 7-8
	0.01% for 10% line change
cle to cycle)	0.025%

m Output: 30V p-p (15V p-p into 50 ohms).

ce: Constant 50 ohms, ±2%.

de Control: Pushbutton attenuator calibrated in 20dB steps and vernier. dB attenuator accuracy ±0.2dB. Minimum out- than 2mV.

ponent: Zero ±100mV, ±4mV/°C, reduced in proportion to uator setting.

cy Response: Sinewave; 0.1dB to 300kHz, 0.2dB to 3MHz, 30MHz. Triangle, 0.1dB to 300kHz, 1dB to 3MHz, 3.5dB to

e Distortion: Less than 0.5% 0.1Hz to 300kHz, 2% to 3MHz, onics at least 22dB down to 30MHz.

aves and Pulses: Rise and fall time less than 10ns, total ns less than 5% with 50 ohm matching load.

Linearity: 99% 0.1Hz to 300kHz, 98% to 3MHz, 90% to

mmetry: 99% on bands 1-7, 90% on band 8.

BLE SYMMETRY: Potentiometer for adjusting negative of pulses and positive slope of ramps. Main tuning dial positive duration of pulses and negative slope of ramps ry ratio adjustable 100:1.

ernal voltage control): Frequency controlled about the dial with zero to +3 volts. Range 1000:1. Slew rate 0.2V/us ce 6k ohms. Upper frequency limited to maximum of band.

FSETS: Fixed offset reduces the waveform to one half its le and sets the plus or minus peak to zero. Variable offset etting about ground to ±15 volts peak. Fixed and variable nay be used simultaneously. Peak AC plus DC offset limited olts.

NAL SYNCHRONIZATION (rear panel): A 2 volt p-p signal will lock generator over a range of 3% with a slight n distortion.

TIONAL MODES (MAIN OUTPUT)

T: Continuous Output, frequency determined by dial and iplier.

E: Continuous output for duration of external or manual gate.

G: Single cycle output when externally or manually triggered.

ST: Repetitive tone burst, rate variable from 0.01Hz to 10kHz.

SE: Pulse output adjustable between 16ns and 100s or single of selected waveform. Rep rate from 0.01Hz to 10kHz.

T SWP: Continuous sweeping between frequencies deter- d by START and STOP controls. Range: 100:1 linear, 1000:1

G SWP: Holds at START frequency, single sweep when ex- lly or manually triggered.

G SWP BURST: Single swept burst when externally or man- triggered.

TRIG/GATE: Manual or external. Waveform start/stop point adjustable ±90° to 300kHz, ±70° to 3MHz. Above 3MHz, generator may free run, unless START PHASE is near zero. Input level variable -5V to +5V. Triggers on positive slope. Maximum trigger frequency, 10MHz. Impedance, 10k ohms.

SWEEP CHARACTERISTICS

Linear or logarithmic. Start and stop frequencies independently selected. Typical accuracy: Linear scale 10% f.s., Log scale 20%. Frequencies may sweep up or down. Sweep may be stopped with sweep hold control. Hold drift: Linear, (0.01Hz/sec) x MULTIPLIER; logarithmic, 0.2% of frequency/sec.

Range: Linear 100:1; Logarithmic 1000:1.

Duration: Variable, 0.1ms to 100s

MARKER CHARACTERISTICS (positive ramp, sweep up only)

Marker frequency set by MARKER dial and MULTIPLIER. Swept frequency pauses at selected marker frequency. Pause variable from 0.1ms to infinity.

Marker accuracy: 2% of full scale, bands 1-7, 3.5% of full scale band 8.

Pause frequency drift: Linear (0.05 Hz/sec) x MULTIPLIER; Log 1% of frequency/sec.

MARK TRIG input (rear panel): Pause-mark start triggered by falling edge of TTL pulse. Any connection disables front panel MARKER dial control.

AUXILIARY OUTPUTS

RAMP OUT: Linear 3V. Impedance 600 ohms.

SWP (log) OUTPUT (rear panel): Amplitude and offset controlled by sweep START and STOP controls.

PEN LIFT (rear panel): TTL pulse, "high" during sweep and marking.

TTL OUT: Frequency and symmetry same as Main Output. Drives up to 10 TTL loads. Rise and fall time less than 6ns. Total aberrations less than 10%. 180° out of phase with main squarewave output. Impedance 50 ohms.

CV (control voltage) OUT: 2mV to 3 volts, proportional to generator frequency. Accuracy 1% on bands 1-7. Impedance 2.4k ohms.

MARK GATE OUT: TTL pulse, variable with MARK DURATION control.

SWEEP STATUS INDICATORS: In sweep modes, indicates Ramp Generator condition. If ramp is held at start or stop, corresponding LED is on. Both LEDS off indicate a Ramp pause or hold. Both LEDS on indicate sweeping period.

OPERATING TEMPERATURE RANGE: 0°C to 50°C.

POWER REQUIREMENTS: Switch selectable, 90-110, 108-132, 180-220, or 216-264 volts, single phase, 50-400 Hz, 60 watts.

DIMENSIONS AND WEIGHTS

Cabinet Size/Weight	H	W	D	Net	Gross
U.S.	5 1/4"	16 5/8"	11 1/2"	16 lb.	18 lb.
Metric	13.3 cm	42.2 cm	29.2 cm	7 kg	8 kg

Specifications apply at 25°C, ±5 °C, with maximum output voltage, dial set between 1 and 30, and SYMMETRY control off.

OPTIONAL RACK-MOUNTING KIT:
Part No. RK-519: Permits installation of the Model 2200 into a standard 19" rack spacing.

Specifications subject to change without notice.

KROHN-HITE CORPORATION

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SECTION I

GENERAL DESCRIPTION

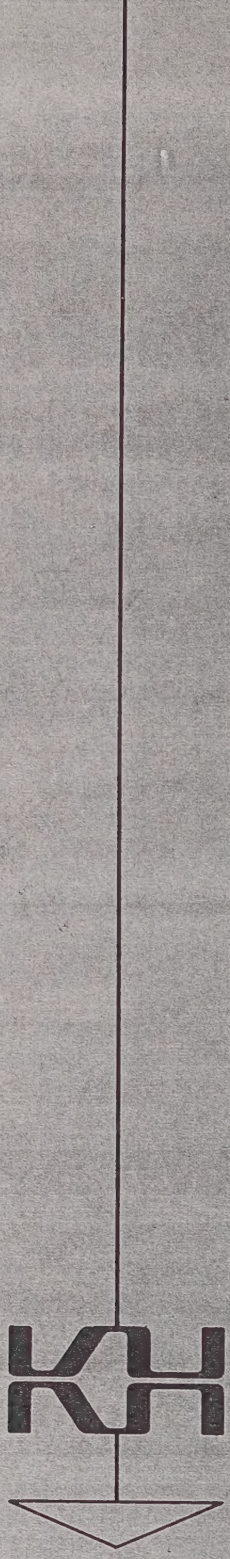
1.1 INTRODUCTION

The Krohn-Hite Model 2200, shown in Figure 1, is a versatile lin/log sweep generator designed for applications in the sub-audio (.003Hz) to high frequency (30MHz) range. It provides 9 differen modes of operation, including up or down linear or log sweeps, gated, burst and pulse-type signals. An exclusive feature of the Model 2200 is the Frequency Pause-Marker. This feature allows the user to stop the up-frequency sweep at any point during the sweep duration, for any period between 0.1ms and infinity. The added convenience of this feature is that it produces a visible marker when the sweep is viewed with an oscilloscope, by driving the scope horizontal axis with the generator's RAMP OUTPUT. The frequency at which the pause-marker occurs can be varied anywhere between the frequency sweep limits, and is accurately indicated by the FREQUENCY Hz MARKER dial.

The Model 2200 provides an output voltage of 30V p-p, open-circui controlled by a calibrated push-button dB attenuator and vernier. The dual DC offset controls provide fixed and/or variable offset capability. The variable SYMMETRY control provides a 100:1 adjustment of the MAIN OUTPUT waveform symmetry ratio, for genera sawtooth or pulse waveforms. (A separate PULSE mode is also provided).

In addition to the above features, several auxiliary outputs are also provided. The TTL output, coincident with the main generato frequency, may be used for gating, blanking, etc. The MARK GATE output is a TTL pulse coincident with the duration of the Frequen Pause-Marker. The PEN LIFT output provides a stylus control when plotting response with an X-Y or strip-chart recorder. The RAMP OUTPUT is a 3 volt ramp coincident with the sweep, and can be used to drive the horizontal axis of an oscilloscope or X-Y plott The ramp output can also be used independent of the main generato in non-sweep modes. Finally, the CV output provides a DC voltage proportional to the generator frequency, accurate within 1% to pr more precise measurement or setting of frequency.

This generator has been carefully inspected, tested, aged, and re adjusted before shipment to insure that it is working properly. If for some reason, the generator is not working properly, or appears to have been damaged in shipment, inform the freight carrier of the damage, and notify KROHN-HITE or its nearest sales office immediately.



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